

Claims

1.

An integrated process for production and upgrading of heavy and extra-heavy crude oil, comprising (a) reforming of hydrocarbons such as natural gas to produce hydrogen, CO₂ and steam (b) separating the produced hydrogen from the CO₂, steam and any other gases to give a hydrogen rich fraction and a CO₂ rich fraction and steam, (c) injecting the steam alone or in combination with the CO₂ rich fraction into a reservoir containing heavy or extra heavy oil to increase the oil recovery, and (d) upgrading/refining of the heavy or extra heavy oil to finished products by extensive hydroprocessing, comprising several steps of hydrocracking and hydrotreating, using the hydrogen rich fraction.

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The process of claim 1, wherein the reforming in step (a) is steam reforming.

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The process of claim 2, wherein the reforming is performed under supercritical conditions.

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20 The process of claim 1, wherein the reforming in step (a) is autothermal reforming or partial oxidation.

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25 The process of claim 4, wherein air is used as oxidizer in the autothermal reformer or in the partial oxidation reactor.

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The process of claim 3, comprising the additional step of air separation to produce purified oxygen comprising more than 95%, preferably more than 98% oxygen, that is used as oxidizer in the reforming.

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The process of claim 6, wherein purified nitrogen co-produced with the purified oxygen is injected into the reservoir together with the CO₂ rich fraction in step (d) to stimulate the oil production.

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The process according to any of the preceding claims, wherein CO produced during the reforming process is reacted in a water gas shift reaction to produce additional CO₂ and H₂.

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The process according to any of the preceding claims, wherein the heavy or extra heavy oil is partially upgraded in the reservoir by hydrogen injection.

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The process according to any of the claims 1 to 8, wherein the heavy or extra heavy oil is partially upgraded in a downhole upgrading unit.

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The process according to any of the preceding claims, wherein the heavy or extra heavy oil is upgraded on an offshore or onshore upgrading facility, employing particular compact process unit design, such as compact gas reforming .

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The process according to any of the preceding claims, wherein at least a part of the heat to increase recovery of the heavy or extra heavy oil is generated by in-situ combustion.

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The process according to any of the claims 1 to 11, wherein geothermal heat is used to increase recovery and transport of the heavy or extra heavy oil.